OCCURENCE OF FUSARIUM HEAD BLIGHT ON SOME WHEAT VARIETIES IN DIFFERENT PLANT POPULATION AND NITROGEN FERTILISATION DURING 2011 IN SERBIA

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Abstract: *Wheat is one of the most important crops in Serbia. The average area under wheat in the Republic of Serbia in the period from 2000 to 2011 year amounted 579,289 ha, with an average yield of 3.48 t/ha. One of the most important diseases on wheat is Fusarium head blight which can cause a number of fungal species from Fusarium genus. Within species Fusarium graminearum, Group 2 is the most important. The consequences of infection of wheat ears by fungi from the genus Fusarium are different, but the most common are: reduced yield, physiological and physico-chemical changes of grain and grain mycotoxin contamination. The aim of the study was to test occurence of natural infection by Fusarium head blight of eight wheat varietes (Arabeska, NS 40S, Zvezdana, Arija, Gora, Gordana, Simonida, Etida), one spelt variety (Nirvana) and one triticale variety (Odisej). The occurence of Fusarium head blight was tested depending on applied amounts (0 kg/ha, 50 kg/ha, 100 kg/ha, 150 kg/ha) of nitrogen fertilizer ammonium nitrate (AN 33-35%N) in the form of spring nitrogen and on sowing density (300 grains/m², 500 grains/m², 700 grains/m², 900 grains/m²). Evaluation of intensity of Fusarium ears occurence was conducted in phenophase of milk stage. Agricultural parameters were monitored at Rimski Šančevi (10 kilometres from Novi Sad) locality during 2011. In May and June 2011 variable and warm weather conditions with less rainfall than average were registered. Weather conditions in May and June 2011 were not favorable for the development of fungi from the genus Fusarium and tested cultivars had low average number of infected ears. The highest average number of infected ears had NS 40S (15.3) and the lowest variety Gordana (2.0). On spelt and triticale variety, there was no significant occurence of the disease caused by fungi from the Fusarium genus. Quantity of applied nitrogen fertilizer as a topdressing wheat showed different effects on development of Fusarium head blight. It was found that the average number of infected ears is not in positive correlation with the applied nitrogen fertilizer, except in the variety Etida. Regarding sowing density effects on Fusarium ear infections, it was registered that NS 40S had the highest number of infected ears compared to other tested varieties regardless sowing density.*

Key words: *Fusarium head blight, varieties, fertilization, sowing density.*

INTRODUCTION

Wheat is one of the most important crops in Serbia. The average area under wheat in the Republic of Serbia in the period from 2000 to 2011 year amounted 579,289 ha, with an average yield of 3.48 t/ha. In the period 2000-2011 in the Autonomous Province of Vojvodina the average area under wheat was 298,329 ha, with the average yield of 3.49 t/ha (STATISTICAL YEARBOOK OF THE REPUBLIC OF SERBIA, 2011).

One of the most important diseases on wheat is Fusarium head blight which can cause a number of fungal species from *Fusarium* genus. Within species *Fusarium graminearum*, Group 2 is the most important (SUTTON, 1982; STACK AND MC MULLEN, 1985; CLEAR AND ABRAMSON, 1986; WIESE, 1987; SOKOLOV, 1993; BAI AND SHANER, 1994; VON RINTELEN, 1995; PARRY, 1995). Fusarium head blight occurs in milky and waxy wheat

maturity as a partial or total decay of the ears that turn yellow in color, straw-like. Under humid conditions on the ear spindle and at the base of a spikelet is formed an orange coat from fungi conidia. In more severe infected ears are created poor grains (MARIĆ AND JEVTIĆ, 2005). Increased humidity in the period of wheat flowering enables release of aeciospores, by which ear infection is predominantly accomplished. The consequences of infection of wheat ears by fungi from the genus *Fusarium* are different, but the most common are: reduced yield, physiological and physico-chemical changes of grain and grain mycotoxin contamination (LEVIĆ, 2008).

The aim of the study was to test occurence of natural infection by Fusarium head blight of eight wheat varietes (Arabeska, NS 40S, Zvezdana, Arija, Gora, Gordana, Simonida, Etida), one spelt variety (Nirvana) and one triticale variety (Odisej). The occurence of Fusarium head blight was tested depending on applied amounts (0 kg/ha, 50 kg/ha, 100 kg/ha, 150 kg/ha) of nitrogen fertilizer ammonium nitrate (AN 33-35% N) in the form of spring nitrogen and on sowing density (300 grains/m², 500 grains/m², 700 grains/m², 900 grains/m²). Evaluation of intensity of Fusarium ears occurence was conducted in phenophase of milk stage.

MATERIAL AND METHODS

The trial was set up at locality Rimski Šančevi, according to the randomized block design in three replications. Each variety was sown in four rows per plot. Four different amounts of ammonite fertilizers were applied: control 0 kg/ha, 50 kg/ha, 100 kg/ha and 150 kg/ha and four soil densities of 300 grains/m^2, 500 grains/m^2, 700 grains /m^2 and 900 grains/m^2.

Before basic tillage, 300 kg/ha of mixed mineral fertilizer NPK 15:15:15 was applied. The wheat was sown on 18th October, 2010. The evaluation of the intensity of occurrence of ears infected by Fusarium head blight was carried out in phenophase of milk stage ripening on 14th June, 2011 and 15th June, 2011.

The obtained results were statistically processed in the program STATISTIKA 10 by variance analysis and Dancan test of multiple intervals.

RESULTS AND DISCUSSIONS

The conditions that favoure the development of Fusarium head blight imply temperature range between 20^{0}C to 30^{0}C in combination with long humid period during flowering. If infected leaves are exposed to high air humidity within the period of 18 hours or shorter, symptoms became visible after prolonged latent period (JEVTIĆ et al., 2012). In May and June 2011 variable and warm weather conditions with less rainfall than average were registered. Mean monthly temperature for May was somewhat lower in relation to the several years average and it was 16.3^{0}C. In May 2011 deficit of precipitation was recorded. In June the average monthly temperature was 20.9^{0}C, which was higher that the several years average. The average quantity of precipitation for this month was 43 mm, which is far below several years average (RHMZ, 2011). Due to weather conditions in May and June 2011 did not favor to the development of fungi from *Fusarium* genus, on studied varieties was found low number of diseased ears, i.e. 0.0 to 15.7 ears with symptoms of Fusarium head blight. However, comparison of the varieties was accomplished on the basis of the given number of ears infected by Fusarioses.

During evaluation in the phenophase of milk stage, symptoms of Fusarium ear rot were visible on eight varieties, while on two varieties, i.e. Nirvana and Odisej, occurrence of the disease caused by fungi of the genus *Fusarium* was not recorded. Infected ears were yellow like straw, while orange mycelium was visible on small number of ears.

Table 1.

The average number of Fusarium ear rot on 5 m^2 in some wheat varieties

Variety	The average number of Fusarium ear rot on 5 m^2	Significance level
NS 40S	15.3	a
Etida	10.3	ab
Arija	9.7	ab
Zvezdana	8.3	abc
Arabeska	8.0	abc
Gora	6.0	bc
Simonida	4.7	bc
Gordana	2.0	bc
Nirvana	0.0	c
Odisej	0.0	c

$LSD_{0.01}$=8.105

In Table 1 is presented the average number of ears infected by Fusarium head blight on 5 m^2 in ten studied varieties with sowing density of 500 grains/m^2. Based upon performed variance analysis and Duncan test of the multiple intervals it was concluded that statistically, the highest number of infected ears was in varieties NS 40S, Etida, Arija, Zvezdana and Arabeska with the values $LSD_{0.01}$=8.105. Between these varieties, there were no statistically significant diferences in number of ears infected by Fusarium head blight.

The highest average number of infected ears had variety NS 40S (15.3), followed by Etida (10.3), Arija (9.7), Zvezdana (8.3) and Arabeska (8.0). The average number of ears with Fusarium head blight had varieties Gora, Simonida and Gordana with 6, 4.7 and 2 ears, respectively and in these varieties statistically significant difference between number of infected ears was not established. In varieties Nirvana and Odisej the occurrence of Fusarium head blight was not recorded.

Table 2.

Average number of Fusarium ear rot and application rate of mineral nitrogen fertilizer

Varieties	Amount of fertilizer applied (kg/ha)	Average number of infected ears on $5m^2$	Significance level
Zvezdana	50	21.3	a
Zvezdana	100	19.0	a b
Etida	150	17.3	a b c
NS 40S	100	16.7	a b c
NS 40S	150	16.7	a b c d
Zvezdana	150	16.7	a b c d
NS 40S	Control	15.3	a b c d e
Etida	100	15.0	a b c d e
Simonida	50	14.3	a b c d e f
Arija	100	13.0	b c d e f g
Simonida	100	11.7	b c d e f g
Simonida	150	11.7	c d e f g h
Etida	50	10.7	c d e f g h
NS 40S	50	10.3	c d e f g h
Etida	Control	10.3	c d e f g h
Arabeska	50	10.0	c d e f g h i
Arija	Control	9.7	c d e f g h i
Arija	150	9.7	c d e f g h i
Arabeska	150	9.3	c d e f g h i
Gora	100	8.7	d e f g h i
Zvezdana	Control	8.3	e f g h i
Gora	150	8.3	e f g h i
Gordana	100	8.3	e f g h i
Arabeska	Control	8.0	e f g h i
Arija	50	8.0	e f g h i
Gordana	150	7.7	e f g h i j
Gora	50	7.0	e f g h i j
Arabeska	100	6.7	f g h i j
Gordana	50	6.7	f g h i j
Gora	Control	6.0	g h i j
Simonida	Control	4.7	h i j
Gordana	Control	2.0	i j
Nirvana	Control	0.0	j
Nirvana	50	0.0	j
Nirvana	100	0.0	j
Nirvana	150	0.0	j
Odisej	Control	0.0	j
Odisej	50	0.0	j
Odisej	100	0.0	j
Odisej	150	0.0	j

In the trial with application of different quantities of fertilizers, the highest average number of ears with Fusarioses had variety Zvezdana with 50 kg/ha of the applied fertilizer nitrogen (Table 2). The same variety had high average number of infected ears after soil dressing with 100 kg/ha, as well as with 150 kg/ha. The average of infected ears in control for this variety was 8.3 per 5 m^2.

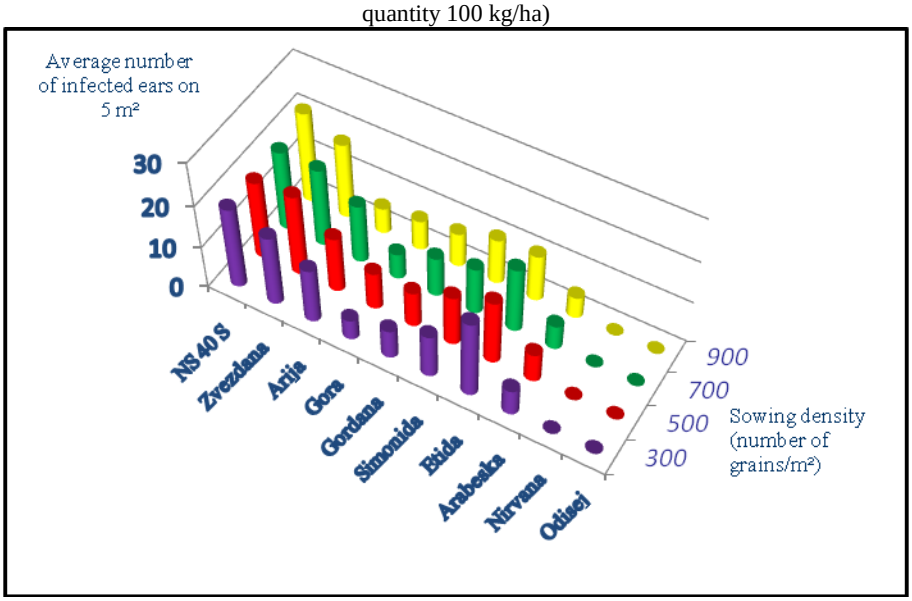
The variety NS 40S had high average number of ears infected by Fusarium head blight after soil dressing with 100 kg/ha and with 150 kg/ha of nitrogen and it was 16.7 per 5 m^2. It is interesting to emphasize that this variety had high number of infected ears even in control, i.e. without application of the fertilizer nitrogen, with the average number of 15 infected ears per 5 m^2. After top fertilization with 50 kg/ha of nitrogen, the average number of infected ears in variety NS 40S was 10.3 per 5 m^2.

The variety Arija had the highest number of ears with Fusarioses after soil dressing of 100 kg/ha of nitrogen fertilizer, in the average, 13.0 per 5 m^2. In control and after application of 150 kg/ha of nitrogen fertilizer, in the same variety, the average number of infected ears was the identical, numbering 9.7 ears per 5 m^2, while after fertilization with 50 kg/ha of nitrogen fertilizer, the number of infected ears was 8.0 per 5 m^2.

It is evident that the average number of infected ears does not follow increase in the applied amount of nitrogen fertilizer. It was expected that the increase in the applied quantities of nitrogen fertilizer lead to the increase in number of infected ears. However, this was observed only for the variety Etida. Deviation from the expected results is the best seen in the variety NS 40S in which higher number of diseased ears was in control, than after top fertilization with 50 kg/ha. Varieties Zvezdana and Simonida had also high average number of infected ears after minimal amount of 50 kg/ha of nitrogen fertilizer.

Graph 1

Impact of sowing density to the occurrence of Fusarium head blight in some wheat varieties (fertilizer quantity 100 kg/ha)

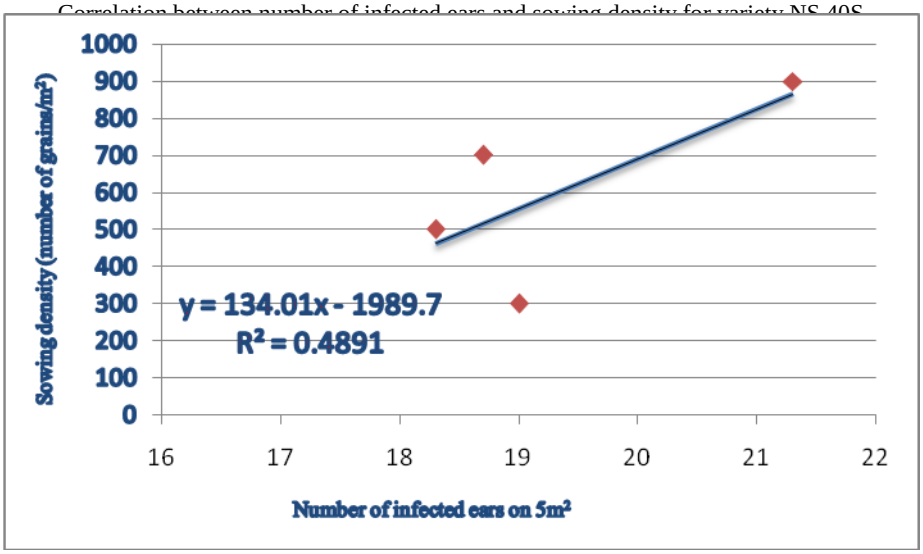


The variety NS 40S had the highest average number of infected ears in comparison to other varieties in all sowing densities (Graph 1). At sowing density of 300 grains/m^2 there were 19 infected ears; sowing density of 500 grains/m^2 resulted in 18.3 infected ears; sowing density of 700 grains/m^2 resulted in 18.3 infected ears, and sowing density of 900 grains /m^2 resulted in 21.3 infected ears. The variety Zvezdana had approximately identical average number of 16.3 infected ears, as well as the variety NS 40S with sowing density of 300 grains/m^2; with sowing density of 500 grains/m^2 there were 19.0 infected ears; sowing density of 700 grains/m^2 resulted with 18.3 infected ears, and sowing density of 900 grains/m^2 had the average number of 17.7 infected ears.

For variety NS 40S, between number of infected ears and sowing density was medium level of correlation (Graph 2) indicating the dependence of spike Fusarioses on wheat sowing density.

Graph 2

Correlation between number of infected ears and sowing density for variety NS 40S



CONCLUSIONS

Based upon the obtained data it can be concluded that on the studied varieties was established low average number of infected ears. Out of ten studied varieties, during evaluation of the trial, symptoms of Fusarium head blight were visible on eight wheat varieties. The highest number of infected ears had variety NS 40S (15.3), and the lowest number had variety Gordana (2.0). In variety of spelt wheat type, such as Nirvana, and variety of triticale, i.e. Odisej, occurrence of the disease caused by fungi belonging to *Fusarium* genus was not recorded.

Quantities of the applied nitrogen for wheat top fertilization showed different impact to the occurrence of Fusarium head blight. It is evident that the average number of infected ears is not followed by increase in the applied quantities of nitrogen fertilizer. In only one variety, i.e. Etida, increase in the applied quantities of nitrogen fertilizer resulted with increase in number of infected ears.

The variety NS 40S had the highest average number of infected ears in comparison to other varieties in all sowing densities. For this variety, between the number of infected ears and sowing density was established medium level of correlation, suggesting that there exists dependence of the occurrence of Fusarium head blight on the wheat sowing density.

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